Holden, Missouri
Water Supply Study
City Lake

Holden Lake is located on a tributary to South Fork Blackwater River, about three Miles Northwest of Holden. Holden is located in Johnson County Missouri.

Average annual rainfall for the last 50 years is 40.0 inches at Warrensburg. Annual rainfall for 1953 through 1957 is 25.4, 32.7, 34.7, 21.1, and 40.0 inches.

Holden has not been reporting their water use. They are using enough water to be considered in the category of major water user and will be reporting their usage. The Safe Drinking Water Information System (SDWIS) database indicates they are currently using an average of 250,000 million gallon per day.

Holden's Lake analysis consisted of using the NRCS's computer program "RESOP". This program analyzes remaining stored water at the end of each month by summing gains and losses.

Following is the data and procedures for input to the "RESOP" program.

STO-AREA Elevation-Storage and Elevation-Area data were determined from June 26, 2003 survey made by USGS.

Holden Lake			
Elevation (Feet)	Area (Acres)	Storage (Ac-Ft)	
802.0	0.07	0.01	
804.0	1.0	0.8	
806.0	3.2	4.9	
808.0	6.2	14	
810.0	10	31	
812.0	17	58	
814.0	26	101	
816.0	36	162	
818.0	47	245	
820.0	58	350	
822.0	74	480	
824.0	90	650	
826.0	105	840	
828.0	124	1070	
830.0	143	1340	
832.0	162	1640	
834.0	184	1990	
836.0	207	2380	
837.0	222	2590	
838.0	237	2820	
840.0	262	3320	
841.3	277	3670	Water Surface on 6/2/2003
841.8	292	3810	Spillway Elevation

LIMITS Full Pool storage 3810 Ac.Ft.
Minimum Pool storage 200 Ac.Ft.

Starting storage was considered at full pool elevation.

The drainage area of the lake is 4.02 square miles.

GENERAL The adjustment factor of 0.76 to convert from pan evaporation to lake evaporation was applied prior to entering the data for the control word EVAP. As a result a factor of 100 is applied.

The record period of drought is in the 1950's.
Analysis began in January 1951 and ended December 1959.

SEEPAGE The reservoir seepage varied from 0 seepage near empty to a maximum of 3.0 inch per month when at full pool. The material in the dam is compacted earth of clayey soils.

RAINFALL Rainfall data came from the Warrensburg, Mo. rain gage for the period 1951 through 1959.

RUNOFF This is the runoff into the lake from its drainage area. Monthly runoff volumes in watershed inches were determined and comparisons were made for the Blackwater River Gage at Blue Lick, South Fork Blackwater River near Elm and Shiloh Creek near Marshall. The three gages yielded similar monthly runoff volumes with Shiloh Creek being the highest. However The Shiloh Creek drainage has a higher percentage of cropland than the other gages. The Blackwater River Gage was used for 1951 to June 1954, when data from South Fork Blackwater River near Elm became available and was used. The drainage area at the South Fork gage is 16.6 square miles. The gage is located East of Warrensburg. The soils and land use in the drainage area of the gage on South Fork Blackwater River and the lake are similar.

In cases where rainfall to runoff values did not appear reasonable, adjustments were made for that Month by looking at individual rains and estimating antecedent moisture and then, adjusting runoff based on NRCS's runoff curve numbers.

EVAP. Pan evaporation at the Lakeside gaging station was used as a base because it has data for year around evaporation. All other stations only measure data between April through November. Lakeside data was updated during these months with gage data from stations at New Franklin, and Columbia. Depending on the latest data for the station nearest to Holden.

DEMAND Holden has not been reporting their water use because they were not considering themselves to be major water users. This RESOP run was for the daily use recorded in the SDWIS data base. The daily amount recorded is 0.250 MGD. The optimized use would be 0.567 million gallon per day.

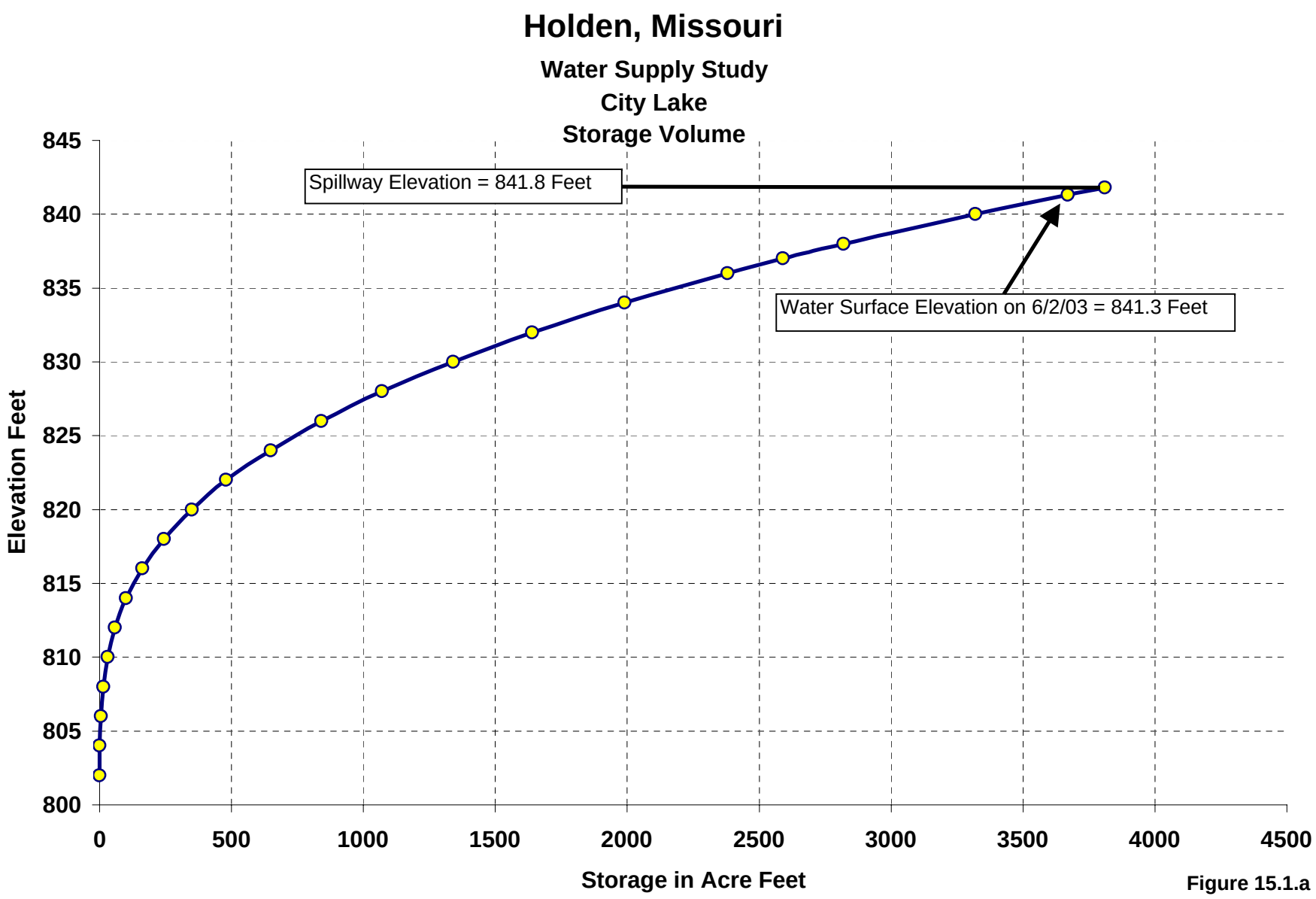

Holden, Missouri
Water Supply Study
City Lake
Storage Volume
Spillway Elevation = 841.8 Feet
Water Surface Elevation on 6/2/03 = 841.3 Feet
Elevation Feet
845
840
835
830
825
820
815
810
805
800
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Storage in Acre Feet

Figure 15.1.a

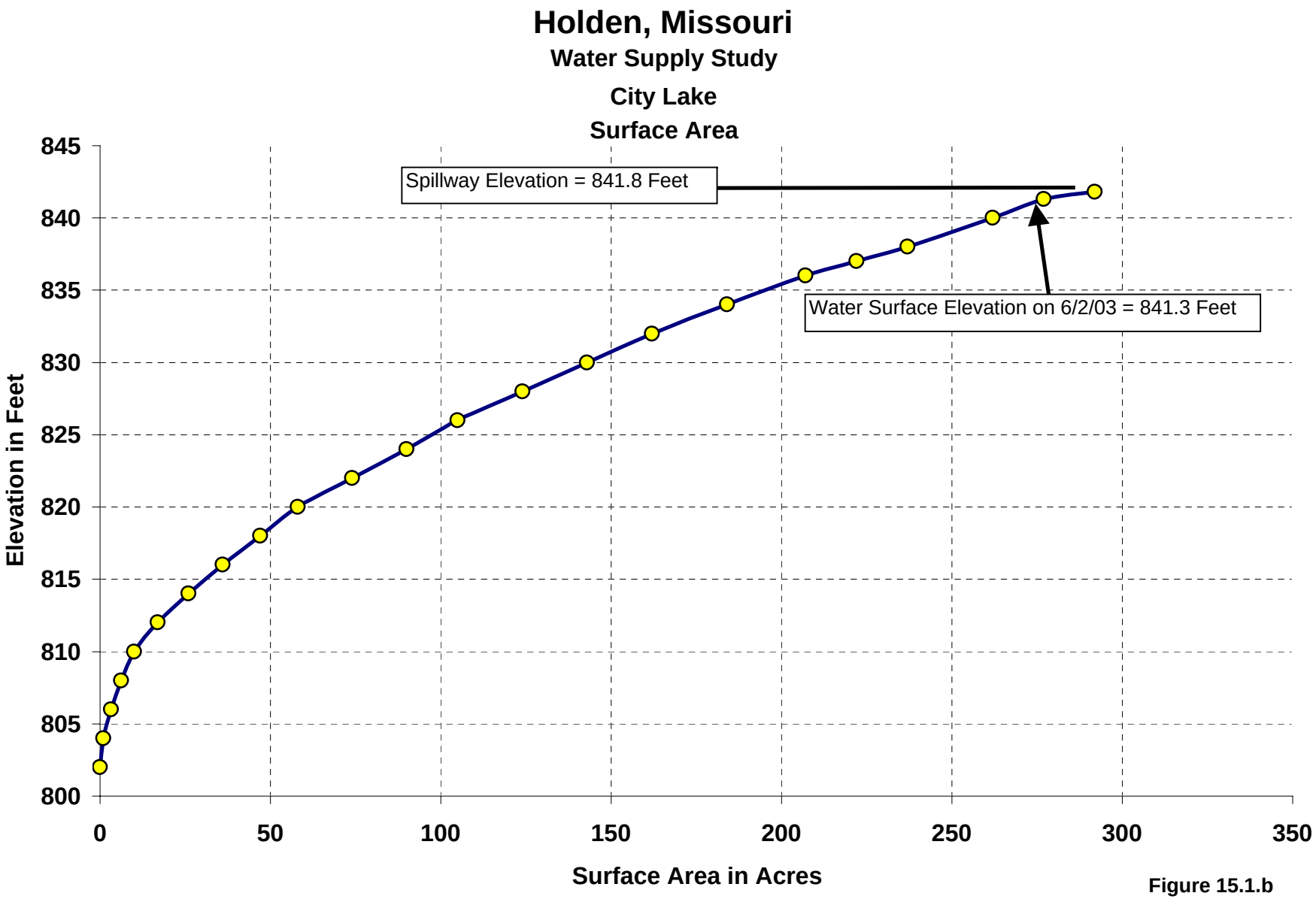

Holden, Missouri
Water Supply Study
City Lake
Surface Area
Spillway Elevation = 841.8 Feet
Water Surface Elevation on 6/2/03 = 841.3 Feet
Elevation in Feet
845
840
835
830
825
820
815
810
805
800
0
50
100
150
200
250
300
350
Surface Area in Acres

Figure 15.1.b

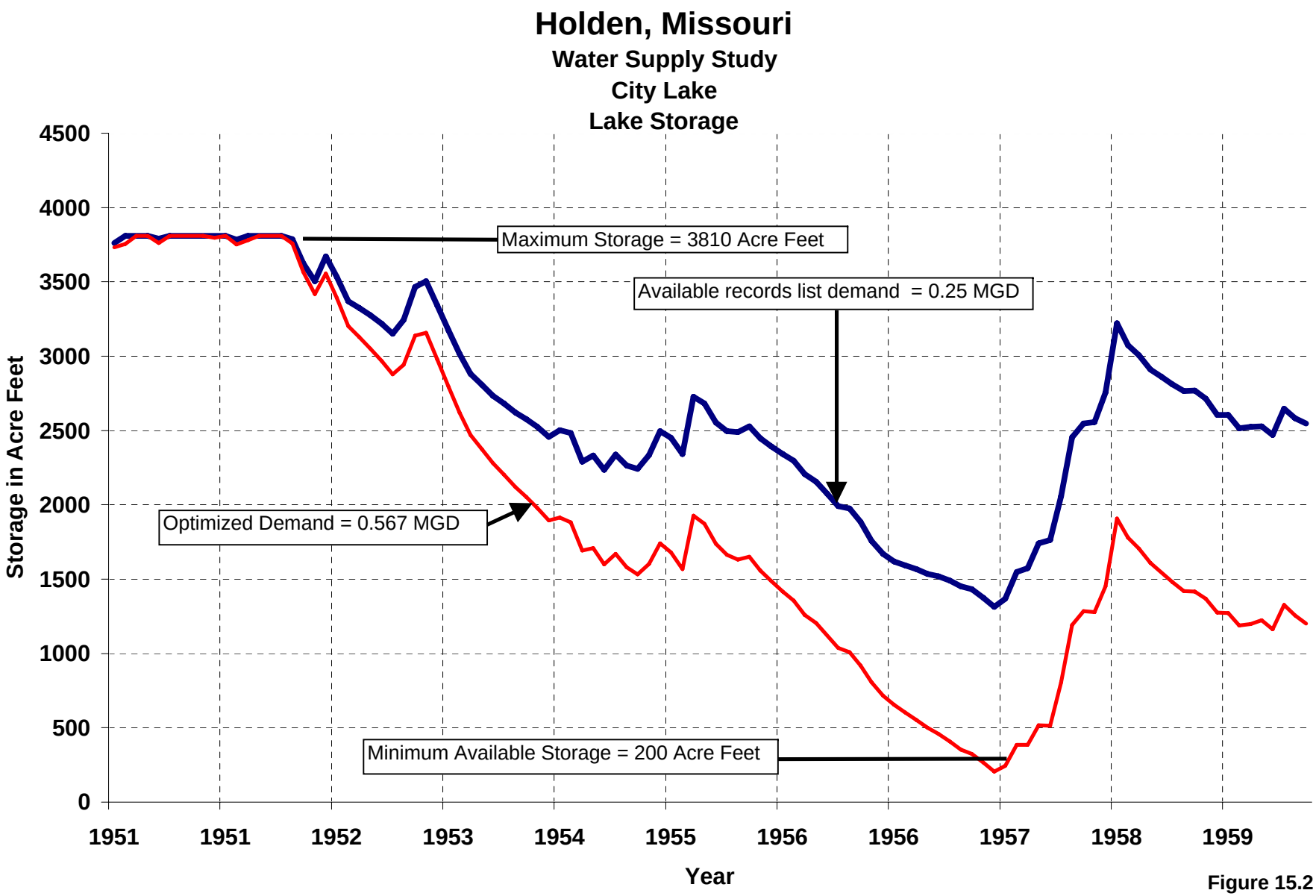
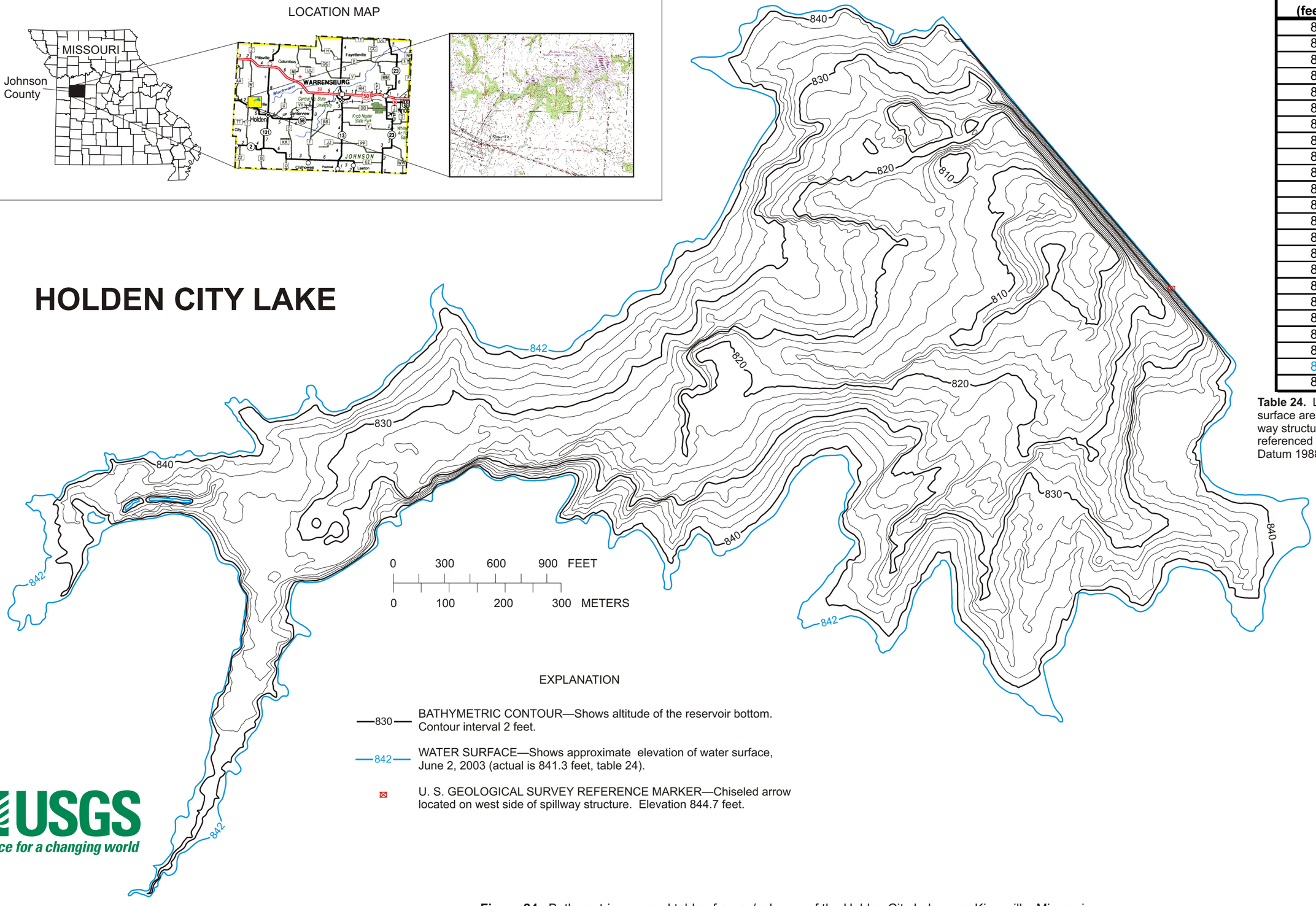

Holden, Missouri
Water Supply Study
City Lake
Lake Storage
Storage in Acre Feet
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Maximum Storage = 3810 Acre Feet
Available records list demand = 0.25 MGD
Optimized Demand = 0.567 MGD
Minimum Available Storage = 200 Acre Feet
1951
1951
1952
1953
1954
1955
1956
1956
1957
1958
1959
Year

Figure 15.2

HOLDEN CITY LAKE



EXPLANATION

830 — BATHYMETRIC CONTOUR—Shows altitude of the reservoir bottom. Contour interval 2 feet.

842 — WATER SURFACE—Shows approximate elevation of water surface, June 2, 2003 (actual is 841.3 feet, table 24).

⊠ U. S. GEOLOGICAL SURVEY REFERENCE MARKER—Chiseled arrow located on west side of spillway structure. Elevation 844.7 feet.

Elevation (feet)	Area (acres)	Volume (acre-ft)
802.0	0.07	0.01
804.0	1.0	0.8
806.0	3.2	4.9
808.0	6.2	14
810.0	10	31
812.0	17	58
814.0	26	101
816.0	36	162
818.0	47	245
820.0	58	350
822.0	74	480
824.0	90	650
826.0	105	840
828.0	124	1,070
830.0	143	1,340
832.0	162	1,640
834.0	184	1,990
836.0	207	2,380
837.0	222	2,590
838.0	237	2,820
840.0	262	3,320
841.3	277	3,670
841.8	292	3,810

Table 24. Lake elevations and respective surface areas and volumes. Top of spillway structure is 841.8 feet. Elevations referenced to North American Vertical Datum 1988 (NAVD 88).

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Figure 24. Bathymetric map and table of areas/volumes of the Holden City Lake near Kingsville, Missouri.

In cooperation with
Missouri Department
of Natural Resources